

## **BeeSpace – An Interactive Environment for Analyzing Nature and Nurture in Societal Roles**

Project Website: [www.beespace.uiuc.edu](http://www.beespace.uiuc.edu)

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One of the most important questions in biology is the origin of behavior: nature or nurture? This research will use genomic biology to liberate the study of behavior from the shackles of this dichotomy. The new paradigm is that the environment (“nurture”), which includes other individuals, impacts an inherited genome (“nature”) by orchestrating gene expression during the lifetime of the animal. This project will analyze social behavior on an unprecedented whole-genome scale, using *Apis mellifera* the Western honey bee, as the model organism. Honey bees live in a complex society governed by an age-related division of labor, with each individual assuming many roles during her lifetime. Both genetic heredity and environmental conditions determine what role a bee performs, and when she performs it. The biology research will generate a unique database of gene expressions for **all** social behavior, recording brain gene expression for hundreds of individuals, each with a specific societal role. These microarray experiments utilize the recently sequenced genome, supported by state-of-the-art statistics. The informatics research will develop an interactive environment to analyze **all** information sources relevant to bee social behavior. These include genome databases from honey bee and related organisms, linked to complete scientific literature relevant to insect behavior. New text mining technology will integrate molecular description with information from physiology, behavior, neuroscience, and evolution. The **BeeSpace** environment will enable users to navigate a uniform space of diverse databases and literature sources for hypothesis development and testing. The software system will go beyond a searchable database, using statistical literature analyses to discover functional relationships between genes and behavior. This research will enable **all** scientists who study bee genes to live on the frontier of integrative biology, where biotechnology enables routine expression analysis and bioinformatics enables functional analysis unconstrained by pre-existing categories.

The broader impact of the interactive environment for functional analysis will be tested in an international community of laboratories studying honey bees and related organisms. Outreach for BeeSpace will provide integrated research and education experiences at the graduate and undergraduate levels, plus training courses and minority outreach at high school and middle school levels.